ISSN 0704-3716

Canadian Translation of Fisheries and Aquatic Sciences

No. 5133

The helminth fauna of the far eastern Dolly Varden (Salvelinus malma) and Kundzha (Salvelinus leucomaenis)

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Original title: K Gel'mintofaune Dal'nevostochnykh mal'my (Salvelinus malma) and Kundzha (Salvelinus leucomaenis)

In: Tr. Gel'mintol. Lab. 12: 52-58, 1962

Original language: Russian

Available from:

Canada Institute for Scientific and Technical Information
National Research Council
Ottawa, Ontario, Canada K1A 0S2

1985

14 typescript pages

Fisheries & Oceans
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MULTILINGUAL SERVICES DIVISION – DIVISION DES SERVICES MULTILINGUES

TRANSLATION BUREAU BUREAU DES TRADUCTIONS

LIBRARY IDENTIFICATION – FICHE SIGNALÉTIQUE

CTFAS 5133

Translated from - Traduction de	Into - En
Russian	English

Author - Auteur

I.P. Mart'yanova-Glebova

Title in English or French - Titre anglais ou français

THE HELMINTH FAUNA OF THE FAR EASTERN DOLLY VARDEN (SALVELINUS MALMA) AND KUNDZHA (SALVELINUS LEUCOMAENIS)

Title in foreign language (Transliterate foreign characters)
Titre en langue étrangère (Transcrire en caractères romains)

K GEL'MINTOFAUNE DAL'NEVOSTOCHNYKH MAL'MY (SALVELINUS MALMA) I KUNDZHI (SALVELINUS LEUCOMAENIS)

Reference in foreign language (Name of book or publication) in full, transliterate foreign characters.
Référence en langue étrangère (Nom du livre ou publication), au complet, transcrire en caractères romains.

Trudy Gel'mintologicheskoi Laboratorii Akademii Nauk SSSR

Reference in English or French - Référence en anglais ou français

Helminthological Laboratory of the USSR Academy of Sciences, **Trudy**

Publisher - Éditeur	DATE OF PUBLICATION / DATE DE PUBLICATION			Page Numbers in original / Numéros des pages dans l'original
–	Year / Année	Volume	Issue No. / Numéro	52–58
Place of Publication / Lieu de publication				Number of typed pages / Nombre de pages dactylographiées
USSR	1962	XII	--	13

Requesting Department / Ministère-Client: DFO

Translation Bureau No. / Notre dossier nº: 1655851

Branch or Division / Direction ou Division: SIPB

Translation (Initials) / Traducteur (Initiales): GAD

Person requesting / Demandé par: P. Power

Your Number / Votre dossier nº:

Date of Request / Date de la demande: December 10th, 1984

UNEDITED TRANSLATION
For information only
TRADUCTION NON REVISEE
Information seulement

FEB - 7 1985

Canada

SEC 5-111 (Rev. 82/11)

Secretary of State / Secrétariat d'État

MULTILINGUAL SERVICES DIVISION – DIVISION DES SERVICES MULTILINGUES

TRANSLATION BUREAU / BUREAU DES TRADUCTIONS

Client's No.–N° du client	Department – Ministère	Division/Branch – Division/Direction	City – Ville
	DFO	SIPB	St. John's, NF
Bureau No.–N° du bureau	**Language – Langue**	**Translator (Initials) – Traducteur (initiales)**	
1655851	Russian	GAD	FEB - 7 1985

Trudy Gel'mintologicheskoi Laboratorii Akademii Nauk SSSR Vol. XII, 1962, pp 52-58, USSR.

THE HELMINTH FAUNA OF THE FAR EASTERN DOLLY VARDEN (SALVELINUS MALMA) AND KUNDZHA (SALVELINUS LEUCOMAENIS)

By I.P. Mart'yanova-Glebova

In investigating the helminth fauna of the fishes of the basin /52* of the Amur River in the summer from 1958 - 1960, work was done in the My and Bol'shaya Iska rivers.

The My River belongs to the Amur zoogeographic district of the Amur transitional region. It rises from the southern slopes of the hills on the banks of the Amur River and flows into the Tatar Strait 100 km to the south of the mouth of the Amur River.

The Bol'shaya Iska River, which belongs to the Sea of Okhotsk basin, originates on the northeast slopes of the hills which are situated to the east of lakes Chlya and Orel' and flows into Schast'ya Bay in the Sea of Okhotsk 150 km to the north of the mouth of the Amur.

Both these rivers are swift and cold. In terms of ichthyofauna, the rivers My and Bol'shaya Iska are characterized by a predominance of fishes of the salmon family, with a complete absence of representatives of the Chinese faunistic complex, established by Nikol'skii (1956).

*The numbers in the right-hand margin indicate the corresponding pages in the original. - Transl.

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SEC 5-25 (Rev. 81/11)

Canada

This paper presents the results of the study of the helminths of two species of fish from these rivers: Salvelinus malma and S. leucomaenis. The helminth fauna of both species of fish from these rivers was not studied until now.

The helminths of S. malma and S. leucomaenis from other bodies of water in the Far East have been studied quite adequately. Information on this question is available in the works of Zschokke, F. and Heitz (1914), Akhmerov (1955), Mamaev, Parukhin, Baeva and Oshmarin (1959), Zhukov (1960) and Strelkov (1960).

Zschokke and Heitz, Akhmerov and Strelkov did studies in different regions of Kamchatka. Mamaev, Parukhin, Baeva and Oshmarin worked in the regions of Primor'e*, Southern Sakhalin and Eastern Kamchatkin. Zhukov gathered material on Putyatin Island in Peter the Great Bay (Sea of Japan).

Table 1 presents the summarized findings of these authors.

As can be seen from Table 1, at present, 38 species of helminths have been registered in S. malma and as many again in S. leucomaenis.

We analysed material from 288 fish. We dissected 126 fish (77 S. malma and 49 S. leucomaenis) from the My River and 162 fish (70 S. malma and 92 S. leucomaenis) from the Bol'shaya Iska.

The fish were studied by the method of complete helminthological dissection, developed by academician K.I. Skryabin.

In all, we found 17 species of helminths in S. malma and S. leucomaenis. The helminths were distributed by class as follows: Trematoda - 4 species, Monogenoidea - 1, Cestoda - 4, Nematoda - 4, Acanthocephala -4.

The Tables shown below give a list of the helminths found on the /53
Bol'shaya Iska River (Table 2) and the My River (Table 3) and indicate

*Primor'e includes the Maritime Territory (Primorskii krai) and the southern part of Khabarovsk krai. - Transl.

the degree of infestation of each species of fish. Moreover, we distinguish two forms in S. leucomaenis: the catadromous and the fresh-water. We have made this subdivision on the basis of the results of helmintholo-gical studies of this species of fish. The justification for this is given below.

Let us briefly analyse the helminth fauna of the fish species which we studied. Both species of fish were 89% invaded by helminths. The Nematoda invasion was the most extensive (76.0%), followed by Acanthocephala (47.9%), Trematoda (32.6%), with Monogenoidea in last place (9.7%).

In all, as we have mentioned, we found 17 species of helminths in S. malma and S. leucomaenis. All these species were previously noted in these fish in the Far East.

In terms of ecological features, the helminths which we found fall /55 into five groups: fresh-water, estuarine, marine, estuarine - fresh-water and estuarine-marine.

The fresh-water parasites make up the largest group. Eight species belong here: 1) Crepidostomum farionis, 2) Tetraonchus alaskiensis, 3) Proteocephalus exiguus, 4) Cyathocephalus truncatus, 5) Neoechinorhynchus rutili, 6) Pseudorhadinorhynchus markewitschi, 7) Cystidicola farionis, 8) Cucullanus truttae.

The marine group comprises five species of helminths: 1) Brachyphallus crenatus, 2) Bucephalopsis gracilescens, 3) Tubulovesicola lindbergi, 4) Echinorhynchus gadi, 5) Anisakis sp. larvae.

The estuarine group includes a single species (Metechinorhynchus salmonis), as does the estuarine - fresh-water group (Eubothrium crassum). Two species (Diplocotyle olrikii, Contracoecum aduncum) constitute the estuarine-marine group.

TABLE 1

HELMINTHS OF FAR EASTERN SALVELINUS MALMA AND SALVELINUS LEUCOMAENIS (FROM PUBLISHED FINDINGS)

Гельминт /	Мальма 2	Кунджа 3	Гельминт /	Мальма 2	Кунджа 3
Trematoda					
Bucephalopsis gracilescens	+	+	*Proteocephallus exiguus* . . .	+	+
Bucephalus basargini	+		*Phyllobothrium caudatum* . .	+	+
Prosorhynchus crucibulum . .	+		*Scolex polymorphus*	+	+
Podocotyle atomon		+	*Nybelinia surmenicola* . . .	+	+
Crepidostomum farionis . . .	+	+	Nematoda		
Orienthophorus petrowi . . .	+		*Capillaria salvelini*		+
Diplostomulum sp. *larvae* . . .	+		*Capillaria curilica*		+
Hemiurus levinseni	+	+	*Dacnitis truttae*	+	+
Parahemiurus merus	+		*Dacnitis laevis*	+	
Lecithaster gibbossus	+	+	*Anisakia* sp. *larvae*	+	+
Genolinea anura		+	*Contracoccum aduncum* . . .	+	+
Tubulovesicola lindbergi . . .		+	*Rhabdochona amago*	+	
Derogenes varicus	+	+	*Rhabdochona salvelini*		+
Brachyphallus crenatus . . .	+	+	*Porrocoecum* sp. *larvae* . . .		+
Azygia robusta	+		*Cystidicola farionis*	+	+
Genarhes mülleri		+	*Metabronema salvelini* . . .	+	+
Monogenoidea			*Philonema oncorhynchi* . . .	+	+
Tetraonchus sp.	+		Acanthocephala		
Cestoda			*Neoechinorhynchus rutili* . . .	+	+
			Echinorhynchus salmonis . . .		+
Cyathocephalus truncatus . .	+	+	*Echinorhynchus gadi*	+	+
Diplocotyle olrikii	+	+	*Echinorhynchus truttae* . . .		+
Diplocotyle sp.		+	*Metechinorhynchus salmonis* .	+	+
Bothriocephalus sp.	+		*Acanthocephalus aculeatus* .	+	
Eubothrium crassum	+	+	*Rhadinorhynchus trachuri* . .	+	
Eubothrium salvelini	+	+	*Bolbosoma caenoforme*	+	+
Plerocerc. «B»		+	*Corynosoma strumosum* . . .	+	+
Diphyllobothrium sp. *larvae*	+	+	4 Итого видов гельминтов	38	38

Key: 1 - helminth; 2 - S. malma; 3 - S. leucomaenis:
4 - Total of helminth species.

In terms of zoogeographic regionalization, the parasites found belong to three groups. The holarctic group comprises 12 helminth species: 1)Crepidostomum farionis, 2) Brachyphallus crenatus, 3) Diplocotyle /56
olrikii, 4) Eubothrium crassum, 5) Proteocephalus exiguus, 6) Cyathocephallus trancatus, 7) Neoechinorhynchus rutili, 8) Metechniorhynchus salmonis,

/54

TABLE 2

THE INFESTATION OF S. MALMA AND S. LEUCOMAENIS OF THE BOL'SHAYA ISKA RIVER WITH HELMINTHS

Гельминт Helminth	1 Мальма, вскрыто 70		4 Кунджа, проходная, вскрыто 70		5 Кунджа жилая, вскрыто 22	
	2 заражено	3 интенсивн.	2 заражено	3 интенсивн.	2 заражено	3 интенсивн.
Trematoda						
Сем. Bucephalidae						
Bucephalopsis gracilescens Rudolphi, 1819	—	—	2	50,120	—	—
Сем. Allocreadidae						
Crepidostomum farionis Müller, 1784	4	1—12	—	—	3	1—11
Сем. Brachyphallidae						
Brachyphallus crenatus Rudolphi 1802	—	—	5	4—6	—	—
Сем. Denuridae						
Tubulovesicola lindbergi Layman, 1937	—	—	66	3—200	—	—
Monogenoidea						
Сем. Tetraonchidae						
Tetraonchus alaskiensis Price, 1937	1	4	27	4—8	—	—
Cestoda						
Сем. Dyplocotylidae						
Dyplocotyle olrikii Krabbe, 1874	—	—	2	2	—	-
Сем. Amphicotylidae						
Eubothrium crassum Bloch, 1779	7	1—4	42	1—27	2	1,20
Сем. Proteocephailidae						
Proteocephalus exiguus La Rue, 1911	5	1—4	—	—	1	1
Сем. Cyathocephalidae						
Cyathocephalus truncatus Pallas, 1781	3	3—4	—	—	—	—
Nematoda						
Сем. Anisakidae						
Anisakis sp. *larvae*	1	1	12	1—3	—	—
Contracoecum aduncum Railliet et Henry, 1912	6	1—2	24	1—7	3	1—10
Сем. Rhabdochonidae						
Cystidicola farionis Fischer, 1798	48	3—120	—	—	15	1—33
Сем. Cucullanidae						
Cucullanus truttae Fabricius, 1794	12	1—5	—	—	1	1
Acanthocephala						
Сем. Neoechinorhynchidae						
Neoechinorhynchus rutili Müller, 1780	12	2—45	—	—	3	1—3
Сем. Echinorhynchidae						
Echinorhynchus gadi Müller, 1776	3	1	—	—	—	—
Pseudorhadinorhynchus markewitschi Achmerov et Dombrowskaya-Achmerova, 1941	2	1—50	—	—	2	2
Metechinorhynchus salmonis Müller, 1780	30	1—5	—	—	13	1—6

Key: 1 - S. malma, 70 dissected; 2 - infested; 3 - intensity;
4 - S. leucomaenis, catadromous, 70 dissected;
5 - S. leucomaenis, fresh-water, 22 dissected.

TABLE 3

INFESTATION OF S. MALMA AND S.LEUCOMAENIS
OF THE MY RIVER WITH HELMINTHS

Гельминт / 1	Малюма, вскрыто 77 / 2		Кунджа живая, вскрыто 49 / 3	
	зараженно / 4	интенсивность / 5	зараженно / 4	интенсивность / 5
Trematoda				
Сем. Allocreadidae				
Crepidostomum farionis Müller, 1784	8	1—3	6	1—10
Cestoda				
Сем. Amphicotylidae				
Eubothrium crassum Bloch, 1779	4	1—4	3	1—11
Сем. Proteocephalidae				
Protocephalus exiguus La Rue, 1911	4	1—2	—	—
Nematoda				
Сем. Anisakidae				
Contracoecum aduncum Ruilliet et Henry, 1912	3	1—2	—	—
Сем. Rhabdochonidae				
Cystidicola farionis Fischer, 1798	44	1—62	37	1—75
Сем. Cucullanidae				
Cucullanus truttae Fabricius, 1794	8	1—5	5	1—2
Acanthocephala				
Сем. Echinorhynchidae				
Echinorhynchus gadi Müller, 1776	1	1	—	—
Pseudoechinorhynchus markewitschi. Achmerov et Dombrowskaya-Achmerova, 1941 .	—	—	17	2—184
Metechinorhynchus salmonis Müller, 1780	41	1—37	14	1—20

Key: 1 - helminth; 2 - S. malma, 77 dissected; 3 - fresh-water S. leucomaenis, 49 dissected; 4 - infested; 5 - intensity.

9) Anisakis sp. larvae, 10) Contracoecum aduncum, 11) Cystidicola farionis, 12) Cucullanus truttae.

The circumpolar group includes: 1) Bucephalopsis gracilescens, 2) Tetraonchus alaskiensis, 3) Echinorhynchus gadi.

The Amur group comprises: 1) Tubulovesicola lindbergi, 2) Pseudorhadinorhynchus markewitschi.

Let us examine the helminth fauna of the individual rivers and individual species of fish which we studied.

On the My River, we found nine species of helminths, eight in S. malma and six in the fresh-water S. leucomaenis. The two species which were found in S. malma but not in S. leucomaenis belong to the marine (Echinorhynchus gadi) and estuarine-marine (Contracoecum aduncum) forms. This fact suggests that the S. leucomaenis in the My River does not go beyonds of the fresh-water - estuarine reach to the sea and limits the distance of its catadromous migration, apparently, to the La Pérouse Strait, without going into the marine region S. malma, whose helminth fauna includes marine elements, apparently goes beyond the estuarine reach of the water area of the Tatar Strait and goes into the estuarine-marine region, and even out to the open sea, which is typical of its biology.

In S. malma and S. leucomaenis of the My River, there is one common estuarine - fresh-water species Eubothrium crassum which infests both these fish in the river and the liman. The fresh-water species of helminths in them differ somewhat. The common fresh-water species for both fish species are: Crepidostomum farionis, Cystidicola farionis and Cucullanus truttae. One estuarine species Metechinorhynchus salmoris

is common. At the same time, S. malma and S. leucomaenis have their "own" fresh-water species of helminths, not having a narrow specificity, which gravitate to them. For example, Proteocephalus exiguus is such a species for S. malma, being absent in S. leucomaenis, while S. leucomaenis has "its" fresh-water Pseudorhadinorhynchus markewitschi, which is not found in S. malma. This fact is convincing grounds for concluding that S. malma and S. leucomaenis in the My River to some extent have different food objects, although ecological conditions in fresh water appear to be identical. We did not find narrowly specific helminth species in S. malma and S. leucomaenis in the My River.

Let us examine the helminth fauna of S. malma and S. leucomaenis of the My River from the point of view of zoogeography. Of the nine helminth species, only one species (Pseudorhadinorhynchus markewitschi) is an Amur form, while the others have a broad distribution. Of these, seven species are found within the holarctic region, besides the Amur zoogeographic transitional region and one species (Echinorhynchus gadi), besides the Amur region, has also been found in the circumpolar subregion.

Our investigations on the My River lasted three years (1958-1960). This allows us to make some conclusions about the dynamics of the infestation of each species of fish with helminths. These conclusions amount to the following.

S. malma. A tendency was observed towards reduction in infestation with Trematoda from 1958 (25%) to 1960 (13.8%). There was some equilibrium in infestation with Cestoda and Nematoda, except for the growing infestation with Cucullanus truttae. There was an increase in the percentage infestation with Acanthocephala (from 45 to 68%).

S. leucomaenis. There was an equilibrium in the infestation with Trematoda, Cestoda and partly Acanthocephala. There was a slight increase in the percentage infestation with Acanthocephala and Nematoda.

Let us now discuss the helminth fauna of S. malma and S. leucomaenis /57 in the Bol'shaya Iska River. In this river, a total of 17 helminth species was found in S. malma and S. leucomaenis. This is almost double the number of hlminth species in the same fish in the My River. The helminths found belong to the following classes: Trematoda - 4 species, Monogenoidea - 1, Cestoda - 4, Nematoda - 4, Acanthocephala - 4. Ecologically, they belong to the following groups: fresh-water - 8, estuarine - 1, estuarine-marine - 2 and marine 5, estuarine - fresh-water - 1. These species belong to the following zoogeographic groups: 14 species have holarctic distribution and of these, two (Bucephalopsis gracilescens and Tetraonchus alaskiensis) belong to the circumpolar subregion. Two species (Tubulovesicola lindbergi and Pseudorhadinorhynchus markewitschi) belong to the Amur region, and only one species (Echinorhynchus gadi) is found in both the Amur region and the circumpolar subregion. Let us examine the species composition of the helminth fauna of S. malma and S. leucomaenis separately. Thirteen helminth species have been found in S. malma. The helminth fauna of S. malma is characterized by a predominance of fresh-water forms, which suggests the intense feeding of S. malma while it is in fresh and freshened water. The presence in it of Echinorhynchus gadi indicates that S. malma goes out to sea, where it becomes infested with this form.

Analysis of the helminth fauna of S. leucomaenis of the Bol'shaya Iska River allows us to distinguish two forms in this species: the fresh-water and the catadromous. We found eight helminth species in the catadromous form of S. leucomaenis. They included: one fresh-water, one estuarine - fresh-water, four marine and two estuarine-marine species.

A special feature of the helminth fauna of this form of S. leucomaenis is the fact that it includes a large number of marine forms, which indicates that the catadromous S. leucomaenis spends more time at sea than in fresh water.

Nine species of helminths were found in the fresh-water S. leucomaenis. Of these, six species were fresh-water, one was estuarine, one was estuarine - fresh-water, and one was estuarine-marine. The helminth fauna of the fresh-water S. leucomaenis is characterized by a predominance of fresh-water species and a complete absence of marine species.

Only the fresh-water S. leucomaenis was noted in the My River. It differs from the fresh-water S. leucomaenis in the Bol'shaya Iska River in having a poorer species makeup of helminths (Proteocephalus exiguus, Neoechinorhynchus rutili and Contracoecum aduncum are absent).

Besides the differences in helminth fauna, the two forms of S. leucomaenis also show differences in other characters: the fresh-water S. leucomaenis is of smaller size and has a different degree of maturity of gonads (3+). There are no references in the ichthyological literature to the existence of two forms in S. leucomaenis, as exist in S. malma (Berg, 1947; Nikol'skii, 1956). One would hope that the phenomenon which we have noted will be confirmed in ichthyological investigations.

Let us discuss the helminths of S. malma and S. leucomaenis in the My and Bol'shaya Iska rivers from the point of view of their epizootological and epidemiological significance. We must note the absence in them of forms which are pathogenic for man and carnivorous animals and birds. As for their pathogenic significance for fish, there is among them not a single speeies which is known for its ability to cause mass epizootics among fish, although each parasite to some extent does damage to its host and in this respect is not indifferent to it.

In conclusion, let us try to explain the differences in helminth fauna in S. malma and S. leucomaenis in the My and Bol'shaya Iska rivers. As was mentioned above, the number of species of helminths in S. leucomaenis and S. malma in the Bol'shaya Iska River is almost twice as great as /58 in the My River (17 and 9).

This phenomenon can be explained by a purely ecological factor, namely: the Bol'shaya Iska River has a broad, shallow delta which is well heated by the sun and where various intermediate hosts (Amphipoda, Copepoda, Crustacea, Lamellibranchia, Insecta, Megaloptera) enjoy the necessary conditions for existence and reproduction. The My River has no such delta, and several swift and comparatively deep channels of the My River flow into the Tatar Strait, failing to provide adequate conditions for the intensive development of the various invertebrates which are the intermediate hosts of the helminths and food for S. leucomaenis and S. malma in this river.

On comparing the helminth fauna of S. malma and S. leucomaenis of the My and Bol'shaya Iska rivers with that from the Ust'-Kamchatka region (Akhmerov, 1955; Strelkov, 1960), Sakhalin, Eastern Kamchatka and Primor'e

(Mamaev et al., 1959) and Peter the Great Bay (Lyaiman, 1939; Zhukov, 1960), one can see the considerable species impoverishment of the helminth fauna of these fish in the My and Bol'shaya Iska rivers. The helminth fauna of S. malma and S. leucomaenis in the My River are especially poor in species. These differences should be considered as features of the different local stocks of S. malma and S. leucomaenis, confined to the bodies of water in question.

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